

# 30th Winter Colloquium on the Physics of Quantum Electronics

9-12 Jan., 2000, Snowbird, Utah  
Sunday Reception, 6:00pm

## Monday Morning

7:20-7:25 Welcoming Remarks

### Plenary

W. Schleich(Uni-Ulm)

7:25-7:55 H. Walther(MPQ)  
*Fock State Preparation in the Micromaser*

7:55-8:25 A. Sokolov/S. Harris(Stanford)  
*Raman Generation by Phased and Antiphased Molecular States*

### Foundations of Quantum Mechanics

M. S. Zubairy(TAMU)

8:30 J. Clauser(Berkeley)  
*Hidden Variable History*

8:50 E. Fry(TAMU)  
*Locality in Quantum Mechanics*

9:10 Y. Shih(Maryland)  
*New Quantum Eraser Experiments*

9:30 M. Scully(TAMU)  
*Coherent control meets thermodynamic dogma*

### High Power Lasers and Laser Physics I

G. McCall(LANL)

E. Duff(Phillips)  
*Directed Energy Overview*

A. Hill(TAMU)  
*TBA*

W. Bohn(Stuttgart)  
*High Power IR Gas Lasers in Europe - Achievements and Perspectives*

9:50-10:10 Coffee Break

### Plenary

M. Feld(MIT)

10:10-10:40 J. Kimble(Caltech)  
*Single Atoms Bound in Orbit by Single Photons*

10:40-11:10 M. Lukin(Harvard)  
*Quantum nonlinear optics with slow photons*

### Nonlinear Optics and Quantum Entanglement

M. Lukin(Harvard)

11:15 C. Bednar(TAMU)  
*Quantum Coherence and Quantum Dense Coding*

11:35 J. Franson(Johns Hopkins)  
*Nonlinear optics at single photon intensities*

11:55 L. Orozco(Stony Brook)  
*Time-resolved Quantum Fluctuations of the Wave Amplitude of Squeezed Light*

12:15 O. Pfister(Virginia)  
*The two-photon laser: a novel source of nonclassical light?*

### Rare Earths I

R. Cone(Montana SU)

A. Craig(Montana SU)  
*Applications involving spectral diversity*

P. Sellin(Montana SU)  
*Stabilized lasers using spectral holes*

A. Steckl(Cincinnati)  
*Optical Properties and Photonic Devices Using Rare-earth-doped GaN*

Y. Sun(Montana SU)  
*Characterization and development of new rare earth optical materials*

### Femtosecond Physics II

R. Boyd(Rochester)

D. Umstadter(U. Michigan)  
*Relativistic nonlinear optics: the interactions of high-intensity-laser pulses with plasmas*

F. Wise(Cornell)  
*Studies of Optical Spatiotemporal Solitons in Quadratic Media*

S. Diddams(JILA)  
*Ultrafast Lasers for Ultrastable Optical Frequency Standards*

R. Allen(TAMU)  
*Responce of Molecules and Materials to Fast Intense Laser Pulses*

### Femtosecond Physics and Applications I

A. Gaeta(Cornell)

A. Gaeta(Cornell)  
*Spatio-temporal collapse of ultrashort pulses: nonlinear dynamics at the femtosecond time scale*

A. Mysyrowicz(LOA-ENSTA)  
*Study of the propagation of intense femtosecond laser pulses through atmosphere*

J. Moloney(Arizona)  
*An Optically Turbulent Atmospheric Light Guide*

A. Rebane(Montana SU)  
*Femtosecond holography and pulse interactions in inhomogenously broadened media*

# 30th Winter Colloquium on the Physics of Quantum Electronics

## Monday Evening

### Plenary

H. Walther(MPQ)

**7:00-7:30** S. Svanberg(Lund)  
*Spectroscopic Lasers for the Diagnostics  
and Treatment of Malignant Disease*

**7:30-8:00** M. Feld(MIT)  
*Diagnosis of Disease with Fluorectance!*

### Optical Microscopy

Bruce Barrett(U. Arizona)

**8:05** N. Kroo(Budapest)  
*Novel Optical Microscopy*

**8:25** J. Rivoal(Paris)  
*Scanning near-field optical microscopy*

### Rare Earths II

A. Craig(Montana SU)

X. Chen(Wheaton)  
*Thermal Effects on the Spectra of Rare  
Earth Ions in Solids*

Z. Hassan(Temple)  
*High Density Fast Spectral Hole Burning in  
Thin Films of II-VI Materials Doped with  
Rare Earths*

**8:45-9:05** Coffee Break

### Coherence Effects I

H. Pilloff(ONR)

R. Boyd(Rochester)  
*New Applications of EIT in Nonlinear and  
Quantum Optics.*

S.-Y. Zhu(Hong Kong)  
*Time delay of light propogation via defect  
modes in one dimensional photonic crystals*

### Plenary

S. Harris(Stanford)

**9:05-9:35** K. Hakuta(Tokyo)  
*Novel radiation source using solid and  
liquid hydrogen*

### Novel Lasers

B. Barrett(U. Arizona)

**9:40** M. Fedorov(Moscow)  
*FEL without inversion: gain optimization*

**10:00** P. Roos/J. Carlsten(Montana SU)  
*Development of nonresonant cw Raman  
Lasers*

### High Power Lasers and Laser Physics II

A. Hill(TAMU)

C. Helms(Phillips)  
*TBA*

H. Bruesselbach/D. Sumida(HRL Labs)  
*High power Yb:YAG lasers*

### Coherent Control I

M. Shapiro(Weizmann)

K. Kompa(MPQ)  
*Femtochemistry - The Vision of Coherent  
Chemistry*

R. Gordon(Illinois)  
*What Have we Learned From the Phase  
Lag in Coherent Control Experiments?*

# 30th Winter Colloquium on the Physics of Quantum Electronics

## Tuesday Morning

### Plenary

N. Bigelow(Rochester)

**7:25-7:55** M. Kasevich(Yale)  
*Atom Interferometer force sensors*

**7:55-8:25** V. Shalaev(NMSU)  
*Nonlinear optics and spectroscopy in fractal and percolation composites*

### Coherence Effects in Solids I

O. Kocharovskaya(TAMU)

**8:30** T. Mossberg(Oregon)  
*Self-Driven Dynamics of Coherently Prepared, Cryogenic, Rare Earth Atoms in a Cavity.*

**8:50** S. Rand(Michigan)  
*Nonlinear Effects and Bistability*

**9:10** O. Kocharovskaya(TAMU)  
*Laser Control of nuclei in solid hosts*

**9:30**

### Nano-Optics I

V. Shalaev(NMSU)

H. Cao(NWU)  
*Microlaser made of Disordered Medium*

J. Feldmann(JILA)  
*Nano-Optics with surface plasmons*

V. Klimov(LANL)  
*Femtosecond spectroscopy of inner- and intra-band transitions in semiconductor quantum dots*

K. Kneipp(Berlin)  
*Linear and non linear Raman probe of single species attached to fractal colloidal structures*

**9:50-10:10** Coffee Break

### Plenary

Y. Yamamoto(Stanford)

**10:10-10:40** J. Sipe(Toronto)  
*"...with a little help from the lattice."  
Coherent current control in the solid state*

**10:40-11:10** G. McCall(LANL)  
*TBA*

### Coherence Effects in Semiconductors

A. Smirl(UIowa)

**11:15** A. Smirl(UIowa)  
*Quantum beating of dynamically interacting excitons in semiconductors: Vectorial dynamics and polarization selection rules*

**11:35** R. Binder(Arizona)  
*Atomic models for semiconductors?*

**11:55** D. Citrin(Washington SU)  
*Dynamics of Excitonic Wavepackets in Semiconductors at High Fields*

**12:15** H. Wang(Oregon)  
*Coupling nanocrystals to a high-Q silica microsphere: cavity QED of semiconductor quantum dots*

### Bose Einstein Condensation(BEC) and Atom Optics

M. Kasevich(Yale)

N. Bigelow(Rochester)  
*TBA*

G. Kurizki(Weizmann)  
*Laser Induced Gravity:  $1/r$  forces in cold gases*

H. Pilloff(ONR)  
*The van der Waals effect on atom guiding of excited states.*

Y. Zhu(Florida)  
*Manipulation of neutral atoms with dark hollow laser beam*

### Nano-Optics II

S.-Y. Zhu(Hong Kong)

C. Bowden(Redstone)  
*Dispersive Properties of finite, one-dimensional photonic band-gap structures*

R. Doering(Texas Inst.)  
*The Challenges of Scaling from Microelectronics to Nanoelectronics*

R. Meltzer(U. Georgia)  
*Rare earth ions in nanostructures*

A. Lagendijk(Amsterdam)  
*Multiple light scattering: from localization to random lasers*

# 30th Winter Colloquium on the Physics of Quantum Electronics

## Tuesday Evening

### Plenary

R. Gordon(Illinois)

**7:00-7:30** M. Shapiro(Weizmann)  
*Control of Chiral Molecule Production and  
Photoassociation of Ultracold Atoms by  
Coherent Population Transfer*

**7:30-8:00** R. Packard(Berkeley)  
*Progress toward a superfluid  $^3\text{He}$  quantum  
interference gyroscope*

### Coherence Effects II

V. Kocharovsky(TAMU)

**8:05** G. Welch(TAMU)  
*Slow Group Velocities and Index  
Enhancement Via Quantum Coherence.*

**8:25** D. Yavuz/S. Harris(Stanford)  
*Eigenvectors of a Raman Medium*

### Gyroscopic Physics

R. Packard(Berkeley)

F. Karwacki(Navy)  
*Multiple quantum well visible light  
micro-structure modulator for a ring laser  
gyroscope.*

S. Aseyev/P. Korkum(Ottawa)  
*Experimental demonstration of optical  
centrifuge for molecules*

### Optical Lattices

M. O'Hare(Dayton)

I. Deutsch(UNM)  
*Entangling atoms in an optical lattice*

V. Milner(UTexas)  
*Chaos and Decoherence in Time-Dependent  
Optical Potentials*

**8:45-9:05** Coffee Break

### Plenary

M. Fedorov(Moscow)

**9:00-9:30** M. Lax(New York)  
*The Lax-Onsager Regression Theorem  
Revisited*

### Coherent Control II

V. Velichansky(TAMU)

**9:40** M. Motzkus(MPQ)  
*Coherent Control in atoms and molecules  
with shaped femtosecond pulses and  
feedback optimization*

**10:00** T. Weinacht (Michigan)  
*Using quantum systems to solve algorithms  
and using algorithms to learn about  
quantum systems*

### Corelated Emission Laser (CEL) Gyro

M. O'Hare(Dayton)

M. S. Zubairy(TAMU)  
*CEL : concepts and recent advances*

J. Bergou(CUNY)  
*Nonlinear theory of CEL gyro*

### Frontiers in Applied Optics

N. Kroo(Budapest)

S. Wilkinson(Raytheon)  
*General Studies in Infrared  
Countermeasure Systems*

J. Dowling(JPL)  
*Quantum Interferometric Lithography*

# 30th Winter Colloquium on the Physics of Quantum Electronics

## Wednesday Morning

### Plenary

M. Lax(New York)

**7:25-7:55** F. Capasso(Lucent)  
*Quantum Cascade Lasers*

**7:55-8:25** A. Cho(Lucent)  
*The Growth of Quantum Cascade Lasers  
and communication Lasers with Solid  
Source Molecular Beam Epitaxy (MBE)*

**8:25-8:45** Award of Lamb Medal to F. Capasso and A. Cho

### Quantum Cascade Lasers

F. Tittel(Rice)

**8:50** F. Tittel(Rice)  
*Spectroscopic Applications of Quantum  
Cascade Lasers.*

**9:10** M. Taubman(JILA)  
*Stabilizing Quantum Cascade Lasers*

**9:30** E. Whittaker(Stevens)  
*Frequency Modulation Spectroscopy Using  
the Quantum Cascade Laser*

### BEC and Atom Optics II

M. Holthaus(Uni-Muenchen)

M. Moore(Arizona)  
*Density independent phase evolution of  
multicomponent condensates*

D. Mueller/D. Anderson(Colorado)  
*Magnetic Guides and a Neutral-Atom  
Beamsplitter*

K. Krutitsky(TAMU)  
*Local-field effects in atom optics and the  
diffraction of dense atomic beams*

**9:50-10:10** Coffee Break

### Plenary

S. Svanberg(Lund)

**10:10-10:40** C. Bennett(IBM)  
*Quantum Information*

**10:40-11:10** L. Cohen(CUNY)  
*Wigner Distributions*

### Quantum Computation

J. Dowling(JPL)

**11:15** G. Chen(TAMU)  
*The universality of the quantum Fourier  
decomposition in forming the basis of  
quantum computation*

**11:35** C. Williams(JPL)  
*Quantum Constraint Satisfaction*

**11:55** L. Wang(NEC)  
*Can an ideal quantum logic gate maintain  
entanglement?*

**12:15** D. Abrams(JPL)  
*Is quantum computing useful?*

### Wigner Distributions and Quantum-Classical Interface

L. Cohen(CUNY)

W. Williams(Michigan)  
*Reduced Interference Time-Frequency  
Distributions*

L. Atlas(Washington)  
*TBA*

P. Loughlin(Pittsburgh)  
*Local Values of Generalized Wigner  
Distributions*

W. Schleich(Uni-Ulm)  
*Wigner Functions and Tunneling*

### Coherence Effects in Solids II

T. Mossberg(Oregon)

G. Pryde(Aust. Nat. U.)  
*Implementation of 'hard optical pulses' and  
NMR-like pulse sequences in optical  
spectroscopy*

Y. Rostovtsev(TAMU)  
*Interference Effects in Solids*

M. Crenshaw(Redstone)  
*Local Field Effects on Spontaneous  
Emission in Multicomponent Media*

O. Keller(Denmark)  
*Index Enhancement & Nonlinear Effects in  
Mesoscopic Media*

# 30th Winter Colloquium on the Physics of Quantum Electronics

## Wednesday Evening

### **Plenary**

Y. Shih(Maryland)

**7:00-7:30** P. Richards(Berkeley)  
*Anisotropy of the cosmic microwave background radiation- Was the early universe a phase conserving linear amplifier?*

### **Squeezed Light**

J. Bergou(CUNY)

**7:35** A. Matsko(TAMU)  
*Reduction of quantum fluctuations of electromagnetic field via coherent medium*

**7:55** M. Xiao(Arkansas)  
*Sub-shot-noise-limited optical heterodyne detection using an amplitude-squeezed local oscillator*

### **BEC and Atom Optics III**

G. Kurizki(Weizmann)

M. Holthaus(Uni-Muenchen)  
*From Bose to Bloch: Solid-state physics with cold atoms*

V. Kocharovsky(TAMU)  
*Fluctuations in BEC*

**8:15-8:35** Coffee Break

### **Plenary**

C. Bowden(Redstone)

**8:35-9:05** Y. Yamamoto(Stanford)  
*Single Photon Turnstile*

### **Coherence effects III**

J. Bergou(CUNY)

**9:10** V. Velichansky(TAMU)  
*High precision magnetometry in dense coherent media*

**9:30** R. Huang(Stanford)  
*Stimulated scattering of excitons into cavity polaritons*

### **Nonlinear Spectroscopy**

J. Sipe(Toronto)

K. Eikema/T. Hänsch(MPQ)  
*Continuous coherent Lyman-alpha radiation: a step closer to antihydrogen physics*

R. Jain(UNM)  
*Advanced Mid-IR Lasers Based on New, Highly-Efficient Cross-Relaxation Processes*

### **Novel Sources of Infrared Radiation**

S. Wilkinson(Raytheon)

T. Chuang(Fibertek)  
*Multi-band Solid-State Laser for Infrared Countermeasures*

A. Belyanin(TAMU)  
*Coherent far-infrared radiation from quantum-dot semiconductor heterostructures*